Nanotech-nology

Multifunctional film fabrication by nano-scale rapid transfer technologies

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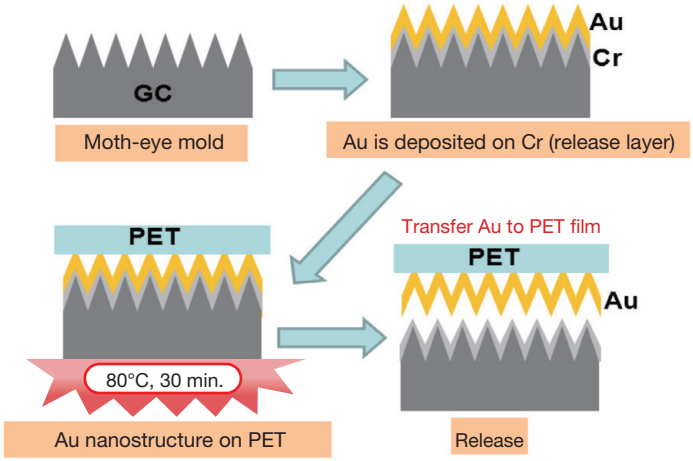
Purpose of Research

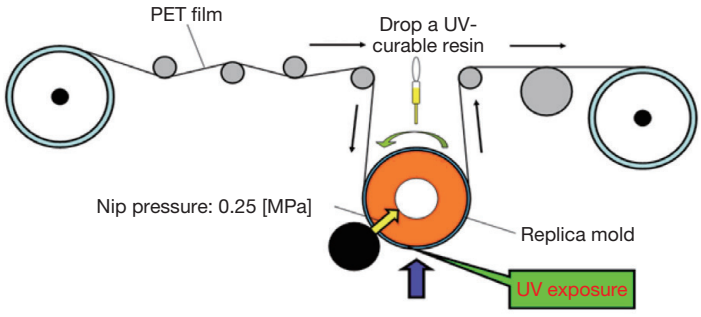
Nanoimprinting is the one of the most common technique for transferring a nanostructure. However, this technique is for forming a pattern on a resin; thus it is not suitable for transfer to metal. In recent years, a "printed electronics," i.e. a bendable electronic device manufactured by distributing a metal wiring on a plastic substrate, has been developed, and a technique for transferring nanometer order metal pattern using a mold also grows in importance. This study aims at satisfying these technical needs with the nanoimprinting.

Summary of Research

Technologies for preparing the nanostructure includes manufacturing a moth-eye (antireflection) structure by irradiating glassy carbon (GC) with oxygen ion beam; and transferring patterns to resin and metal from the manufactured moth-eye mold. Nanoimprinting for the resin and the meal release layer for the metal can allow the patterns to be formed on PET. Moreover, the researchers have advanced the research to achieve the roll-to-roll continuous transfer. It will enable the rapid (with a speed similar to printing) and bulk production of the metal nanostructure as well as the resin nanostructure.



Metallic moth-eye structure can be transferred by NIL



Roll-to-roll Nanoimprint lithography (RTR-NIL)

Comparison with Conventional or Competitive Technology

Releasing (demolding) is the one of the most important points in transferring nanometer order pattern to resin or metal. Out laboratory formulates a proper releasing method and enables transfer from the metal. Nanotransfer using a roll, like a printing, and rapid transfer are also established.

Expected Applications

- Printable electronics (e.g. IC tag, sensor, etc.)
- Wearable devices (e.g. sensor, etc.)
- Optical film (e.g. antireflection film, etc.)

Challenges in Implementation

The mold cost tends to be too high, but our laboratory possesses a technology which enables to prepare a plurality of transfer molds from only one master by creating replicas. Moreover, a large-area mold is difficult to manufacture but our laboratory succeeds to extend the single mold by tiling, provided that the joints are improperly visible.

What We Expect from Companies

We are finding the company as a collaborative project partner, who is willing to build new articles.

Future Developments

A functional film with a nanostructure provides greater novel values to products in various fields including but not limited to displays, automobile components, touch-screens and mobile device. We are willing to cooperate with the companies who demand such new functions and technologies.

- Associated System: JST A-STEP "High-risk Challenge" type
- Awards: MNE 2014 "Best Poster Awards"
- Intellectual Property: Japanese Patent No. 04550089 "Antireflection Structure Body, Method for Preparing the Same, and Method for Preparing Optical Member" US8328371 "Anti-reflection structure body, method of producing the same and method of producing optical member" EP2065736 "Antireflection structure, process for producing the same and process for producing optical member"
- Prototype: Present
- Sample: Available

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